Guidance

GCSE Subject Level Guidance for Mathematics

June 2015

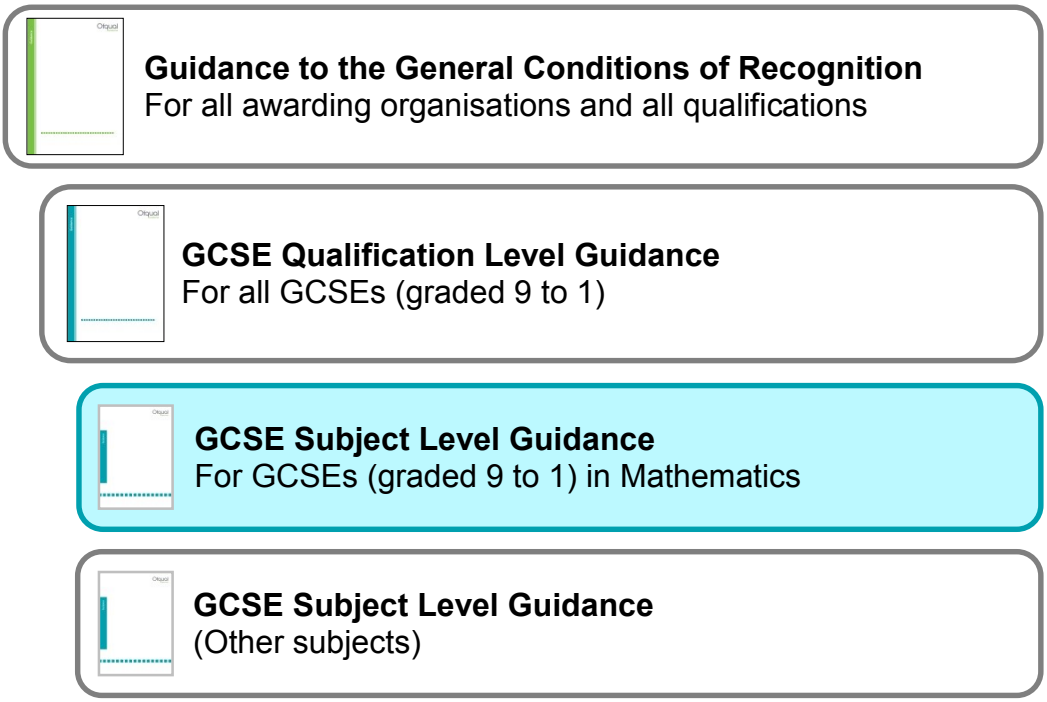
Ofqual/15/5722 (previous version Ofqual/14/5452)

Contents

Introduction

About this document

This document (highlighted in the figure below) is part of a suite of documents which outlines our guidance for awarding organisations offering GCSE Qualifications (graded 9 to 1).



This document sets out guidance which applies to all GCSE Qualifications (graded from 9 to 1) in Mathematics. It supports both:

- the GCSE Qualification Level Conditions and associated requirements;[1] and
- the GCSE Subject Level Conditions and associated requirements for Mathematics.[2]

This document constitutes guidance for the purposes of section 153 of the Apprenticeships, Skills, Children and Learning Act 2009 (the '2009 Act'). It also includes guidance issued under Condition GCSE(Mathematics)1.1(c).

[1] www.gov.uk/government/publications/gcse-9-to-1-qualification-level-conditions

[2] www.gov.uk/government/publications/gcse-9-to-1-subject-level-conditions-and-requirements-for-mathematics

An awarding organisation has a legal obligation under the 2009 Act to have regard to this guidance in relation to each GCSE Qualification in Mathematics that it makes available or proposes to make available. Condition GCSE(Mathematics)1.1(c) imposes the same obligation in respect of the guidance below which is issued under that Condition.

An awarding organisation should use this guidance to help it understand how to comply with the GCSE Qualification Level Conditions as they apply specifically to GCSE Qualifications (graded from 9 to 1) in Mathematics, together with the GCSE Subject Level Conditions and associated requirements for such qualifications.

Revisions to this document

We have revised this document since it was originally published (see Appendix 1 for details), most recently in June 2015.

The June 2015 version of this document replaces all previous versions of *GCSE Subject Level Guidance for Mathematics* with effect from 12.01am on Tuesday 30 June 2015.

Guidance set out in this document

This document provides guidance on minimum assessment time, and on assessment objectives, for GCSE Qualifications (graded 9 to 1) in Mathematics

Guidance on minimum assessment time for GCSE Qualifications in Mathematics

Condition GCSE4.1 states that all assessments for a GCSE Qualification in Mathematics shall be Assessments by Examination.

We expect that an awarding organisation will design and set such assessments on the basis that the total amount of time spent by each Learner in taking those assessments should be no less than four-and-a-half hours.

Guidance on assessment objectives for GCSE Qualifications in Mathematics

The assessment objectives for GCSE Qualifications (graded 9 to 1) in Mathematics are set out in the Department for Education's publication *GCSE mathematics: subject content and assessment objectives*[3] (the 'Content Document'). The assessment objectives set out in that document are reproduced in the table below.

Assessment objectives		Weighting	
		Higher	Foundation
AO1	Use and apply standard techniques Students should be able to: ■ accurately recall facts, terminology and definitions ■ use and interpret notation correctly ■ accurately carry out routine procedures or set tasks requiring multi-step solutions	40%	50%
AO2	Reason, interpret and communicate mathematically Students should be able to: ■ make deductions, inferences and draw conclusions from mathematical information ■ construct chains of reasoning to achieve a given result ■ interpret and communicate information accurately ■ present arguments and proofs ■ assess the validity of an argument and critically evaluate a given way of presenting information Where problems require candidates to 'use and apply standard techniques' or to	30%	25%

[3] Department for Education (November 2013) *GCSE mathematics: subject content and assessment objectives*, DFE-00233-2013, www.gov.uk/government/publications/gcse-mathematics-subject-content-and-assessment-objectives

	independently 'solve problems' a proportion of those marks should be attributed to the corresponding Assessment Objective		
AO3	Solve problems within mathematics and in other contexts Students should be able to: ■ translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes ■ make and use connections between different parts of mathematics ■ interpret results in the context of the given problem ■ evaluate methods used and results obtained ■ evaluate solutions to identify how they may have been affected by assumptions made Where problems require candidates to 'use and apply standard techniques' or to 'reason, interpret and communicate mathematically' a proportion of those marks should be attributed to the corresponding Assessment Objective	30%	25%

Condition GCSE(Mathematics)1.1(c) requires awarding organisations to interpret the Content Document having regard to any guidance published by Ofqual.

We set out below our guidance for the purposes of Condition GCSE(Mathematics)1.1(c). This guidance explains how we expect awarding organisations to interpret these assessment objectives in terms of:

- the different 'strands' within each of the assessment objectives;
- the further discrete 'elements' within each assessment objective and its strands, which questions and tasks could target and/or seek to credit – our expectation is that each and every question/task should target or seek to credit at least one of these elements, and may target or seek to credit multiple elements across one or more assessment objectives;

- the coverage expectations, such as in relation to the different strands and elements within each assessment objective and how those strands and elements should be sampled over time; and
- the key areas of emphasis in each assessment objective and the particular meaning for the subject of any key terms and phrases used; defined terms are shown in bold text, followed by their definitions.

In line with the obligations set out in Condition GCSE(Mathematics)1.1(c), we expect awarding organisations to be able to demonstrate how they have had regard to this guidance. For example, an awarding organisation could map how it has regard to the guidance as it:

- develops its sample assessment materials;
- delivers the qualification;
- develops and applies its approach to sampling the elements into which the assessment objectives are divided; and
- monitors the qualification to make sure it addresses all elements appropriately.

AO1: Use and apply standard techniques			*50% (Foundation Tier)* *40% (Higher Tier)*
Strands	**Elements**	**Coverage**	**Interpretations and definitions**
1 – Accurately recall facts, terminology and definitions	*The strand is a single element*	Full coverage in each set of assessments (but not in every assessment)	▪ The weighting for this element should be no more than 10% of the AO1 marks at each tier.
2 – Use and interpret notation correctly	*The strand is a single element*	Full coverage in each set of assessments (but not in every assessment)	▪ The weighting for this element should be no more than 10% of the AO1 marks at each tier.
3 – Accurately carry out routine procedures or set tasks requiring multi-step solutions	3a – Accurately carry out routine procedures	Full coverage in each set of assessments (but not in every assessment)	▪ The combined weighting for these elements should be at least 80% of the AO1 marks at each tier. ▪ Generally speaking, there would be more 3a than 3b marks at Foundation Tier and more 3b than 3a marks at Higher Tier. ▪ **Routine procedures** – the task makes clear the procedure to be used; there is no significant background context that would have an impact on the demands; the procedure should be familiar to Learners as stated in the specification. ▪ **Multi-step solutions** – the processes are sequential but are also discrete; the response has to generate the linkages between them. ▪ **Standard techniques** – although AO2 and AO3 may have as a foundation the processes addressed by AO1, the majority of the marks for such items or item parts should be credited to the Learners' engagement with the full task requirements (AO2 or AO3) rather than the processes themselves (AO1).
	3b – Accurately carry out set tasks requiring multi-step solutions	Full coverage in each set of assessments (but not in every assessment)	

AO2: Reason, interpret and communicate mathematically			25% (Foundation Tier) 30% (Higher Tier)
Strands	**Elements**	**Coverage**	**Interpretations and definitions**
1 – Make deductions, inferences and draw conclusions from mathematical information	1a – Make deductions to draw conclusions from mathematical information	Full coverage in each set of assessments (but not in every assessment)	▪ Strands 1/2/3/4 (but not strand 5) operate on a continuum – they all relate to reasoning, but increase in their level of sophistication; they also vary in terms of whether the Learner is working towards a provided outcome or generating this. ▪ **Deduction** – a process of reasoning from absolutes to results that must be correct ▪ **Inference** – a process of reasoning from more relative or partial evidence to results that are likely to be correct. ▪ **Conclusion** – the result obtained either from a deduction or from an inference.
	1b – Make inferences to draw conclusions from mathematical information	Full coverage in each set of assessments (but not in every assessment)	
2 – Construct chains of reasoning to achieve a given result	*The strand is a single element*	Full coverage in each set of assessments (but not in every assessment)	▪ **Given result** – an outcome that is provided to the Learner; a specific answer required by the task.
3 – Interpret and communicate information accurately	3a – Interpret information accurately	Full coverage in each set of assessments (but not in every assessment)	▪ **Interpret** – working with information in a way that extends beyond what it conveys explicitly.
	3b – Communicate information accurately	Full coverage in each set of assessments (but not in every assessment)	▪ **Communicate** – presenting information in a way that may involve taking something and representing it differently.

AO2: Reason, interpret and communicate mathematically			*25% (Foundation Tier)* *30% (Higher Tier)*
4 – Present arguments and proofs	4a – Present arguments	Full coverage in each set of assessments (but not in every assessment)	▪ **Argument** – a formal, comprehensive and logical account – but with a degree of relativity, such that it may vary in accuracy at different points.
	4b – Present proofs	Full coverage in each set of assessments (but not in every assessment)	▪ **Proof** – a formal, comprehensive and logical account – but also with a degree of absoluteness and incontrovertibility, such that it would be the case at any point; based on the subject content, this will be a requirement at Higher Tier only.
5 – Assess the validity of an argument and critically evaluate a given way of presenting information	5a – Assess the validity of an argument	Full coverage in each set of assessments (but not in every assessment)	▪ Although they are related to each other elements 5a and 5b are distinct.
	5b – Critically evaluate a given way of presenting information	Full coverage in each set of assessments (but not in every assessment)	

AO3: Solve problems within mathematics and in other contexts			25% (Foundation Tier) 30% (Higher Tier)
Strands	**Elements**	**Coverage**	**Interpretations and definitions**
1 – Translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes	1a – Translate problems in mathematical contexts into a process 1b – Translate problems in mathematical contexts into a series of processes 1c – Translate problems in non-mathematical contexts into a process 1d – Translate problems in non-mathematical contexts into a series of processes	▪ Full coverage over the shortest possible time period (but not in each set of assessments) ▪ Each series should include problems in both mathematical and non-mathematical contexts, as well as both translation into a process and a series of processes – but this may be done in any combination	▪ In the context of this assessment objective, a 'task' is a set of requirements focusing on one problem. ▪ Tasks may be broken down into a number of steps or parts, provided this does not undermine the expectation of students demonstrating their ability to solve problems as a coherent process. ▪ Tasks should place the emphasis on the Learner's own decision-making. They should require Learners to solve problems without the procedures that should be used being clear from the question or task. ▪ The strands of AO3 reflect a problem-solving cycle and as such could be considered as parts of a continuum rather than as independent strands. Each assessment series should provide opportunities for Learners to undertake extended, or multi-step, tasks. ▪ At least one-third of AO3 marks within an assessment series for a single tier should be allocated to tasks which target two or more strands of AO3. Within these multiple-strand tasks, all strands of AO3 should be addressed in each assessment series. ▪ There should be a greater emphasis for both tiers on strands 1/2/3 rather than on strands 4/5. Within strand 1, there should

<table>
<tr><th colspan="3">AO3: Solve problems within mathematics and in other contexts</th><th>25% (Foundation Tier)
30% (Higher Tier)</th></tr>
<tr><th>Strands</th><th>Elements</th><th>Coverage</th><th>Interpretations and definitions</th></tr>
<tr><td>2 – Make and use connections between different parts of mathematics</td><td>The strand is a single element</td><td>Full coverage in each set of assessments (but not in every assessment)</td><td rowspan="4">be a greater emphasis on 1b and 1d than 1a and 1c to ensure an appropriate amount of multi-step problem-solving tasks within each assessment series.
■ Where relevant, responses should be expected to be presented such that they are within the frame of the original problem rather than in the abstract.
■ It is possible to have tasks where all the marks are allocated to AO3 but, in such situations, each mark must be awarded against the AO3 strands and elements. It will often be the case that, within a problem-solving task, if the task resolves into a routine procedure and if marks are awarded for the carrying out of that procedure accurately, then those marks must be allocated to AO1.
■ Responses should not require explanation or justification as this is the focus in AO2, but working should usually be indicated to ensure that partially correct AO3 responses can still be credited. However, it may be appropriate in some cases that partial credit can still be given even where working is not shown – this would be reflected in mark schemes.
■ Within strand 2, Learners should only be credited for making connections they have generated, rather than any linkages which are explicit in the task.
■ Within strands 4 and 5, marks may be awarded for methods</td></tr>
<tr><td>3 – Interpret results in the context of the given problem</td><td>The strand is a single element</td><td>Full coverage in each set of assessments (but not in every assessment)</td></tr>
<tr><td rowspan="2">4 – Evaluate methods used and results obtained</td><td>4a – Evaluate methods used</td><td>Full coverage in each set of assessments (but not in every assessment)</td></tr>
<tr><td>4b – Evaluate results obtained</td><td>Full coverage in each set of assessments (but not in every assessment)</td></tr>
</table>

AO3: Solve problems within mathematics and in other contexts			25% (Foundation Tier) 30% (Higher Tier)
Strands	**Elements**	**Coverage**	**Interpretations and definitions**
5 – Evaluate solutions to identify how they may have been affected by assumptions made	*The strand is a single element*	Full coverage in each set of assessments (but not in every assessment)	used, results obtained and/or solutions and assumptions generated by the Learner or provided to the Learner. It should not be understood as pertaining solely to mathematical modelling.

Appendix 1 – Revisions to this document

The table below sets out all revisions to this document since it was first published, and the dates on which those revisions came into force.

Revision	Date in force
Guidance on assessment objectives (revised)	30th June 2015
First published	23rd May 2014

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